A NEW SUBSPECIES OF ZEA MAYS L.

DR. WALTER B. GERNERT

UNIVERSITY OF ILLINOIS

WHILE harvesting a plot of yellow dent corn, a strain of the Leaming variety grown on the Illinois Agricultural Experiment Station fields in 1909, one of the workmen found a peculiarly shaped ear which was laid aside in the drying-room as a curiosity. The corn in which this ear was found came from a strain that had been subjected for several generations to an ear-row selection for high protein content by a mechanical inspection of the endosperm.[1]

This new type of ear which reproduces faithfully in its progeny is cone-shaped in outline and gives the appearance externally of being composed of a mass of kernels borne on numerous irregular branches (see "*a*" in the figure). A longitudinal section (at "*b*") displayed kernels throughout the ear.

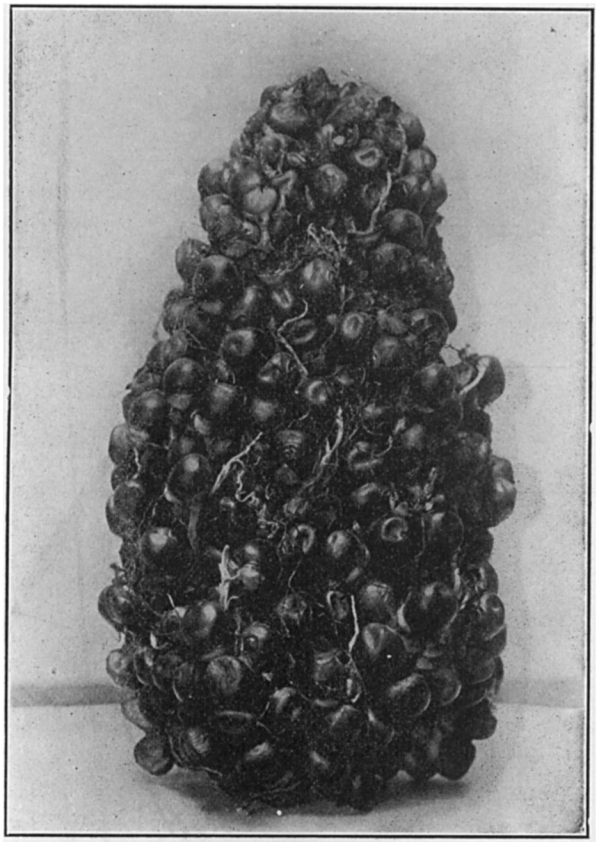
The "branched" form is a prolification of the fleshy type of 4 to 30 or more-rowed cob common to all varieties that to the writer's knowledge have been described to date. For this new type the writer proposes the name *Zea ramosa,* from the Latin "*ramosus*—having many branches." This name is proposed in conformity with the bi-nomial classification of Sturtevant[2] which is now generally recognized. We will not here discuss the precedence nor the desirability of Sturtevant's nomenclature for the subspecies of corn which were all grouped at first by Linnæus under the general head *Zea mays.*

The new type *Z. ramosa* (branched) is as much deserving of a specific name as are any of the six groups recognized by Sturtevant, namely: *tunicata* (pod), *everta* (pop), *indurata* (flint), *indentata* (dent), *amylacea* (soft), *saccharata* (sweet). The first of these six groups has a more or less monstrous development of glumes into pods which inclose each kernel on the ear with leafy bracts known as the husks. The classification of the other five groups is based on differences in characters situated in the endosperm of the kernel.

[1] Representative samples of the ears thus obtained for planting in the next year were also analyzed chemically to determine the efficiency of the method of mechanical selection.

[2] Sturtevant, E. L., *Bul. Torr. Bot. Club,* 21: 319–343, 1894; Off. Exp. Sta. U. S. D. A., Bul. 57: 7–108, 1899.

The ear of *Z. ramosa,* which is always of a definite form, is borne at the usual place near the middle of the culm and is not to be confused with sparsely branched ears sometimes found on the culm nor with ears frequently found in the tassels on ordi-

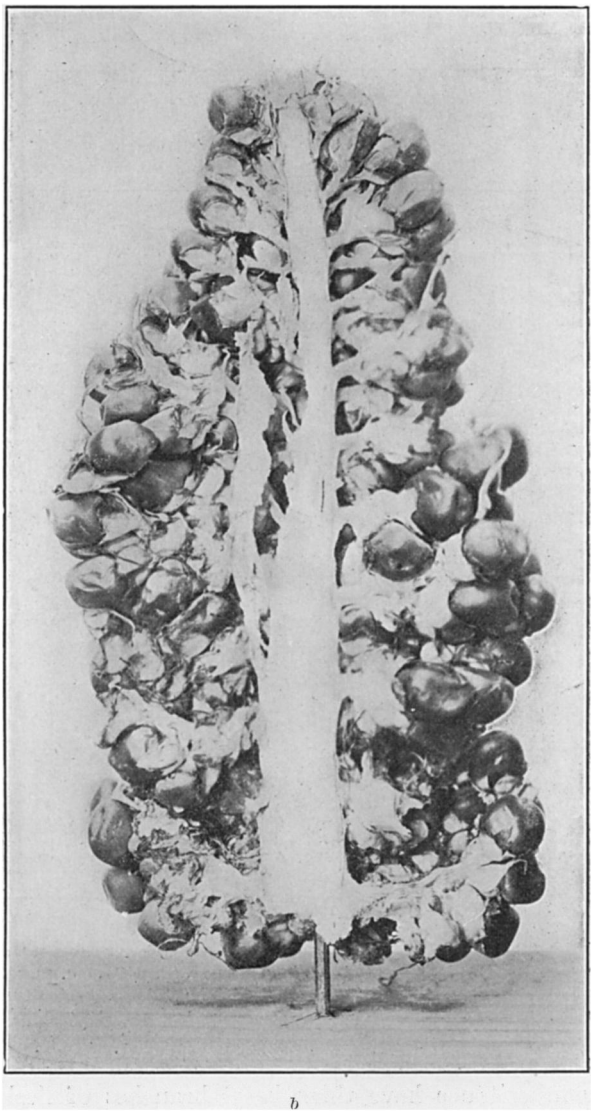


a

THE NEW TYPE OF EAR AND TASSEL IN CORN (*Zea ramosa*). *a,* external view of parent ear. *b,* longitudinal section of same (p. 619). *c,* tassel (p. 620). Photographs by Flora Sims and by courtesy of the Illinois Agricultural Experiment Station.

nary corn plants. Such abnormalities which are fluctuating in their inheritance have thick basal branches of fleshy cob—which may be as long or longer than the primary cob itself—and may bear from two to a dozen or more rows of kernels on each branch. Furthermore, no male florets have as yet been found in any of the ears of *Z. ramosa* and they are always covered with normal husks.

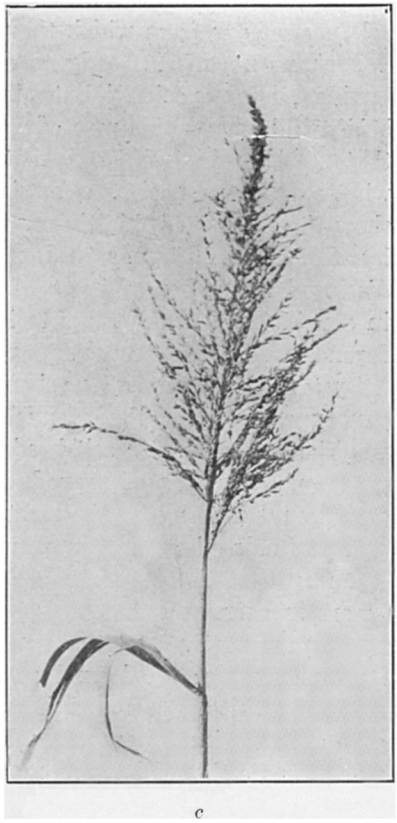
A feature of especial interest in the new type is the fact that the tassels of such plants are also invariably much branched and



b

cone-shaped. (A reduced photograph of the tassel is shown at "*c.*") No instance has yet appeared in which this correlation did not exist.

During the last three years the writer has had under observation a large number of varieties and their hybrids. He has been able to isolate more than a dozen tassel types which are strikingly different in shape and which are distinct from each other in inheritance. Some of the characters of these types are plainly correlated with certain characters of the ear. Advantage can undoubtedly be taken of this fact in analyzing the behavior of such fluctuating phenomena as size, shape, and number of parts.



c

This correlation between tassel and ear permits the selection of individuals in the field before the silks appear. These plants may then be bagged and hand pollenated at will. In an investigation not yet published, the writer has found that the tassels in a large number of varieties are usually out and fully expanded one or more days before any pollen is shed from the anthers, while the tassels produce pollen at an average of from one to three days before the silks appear on the same plants.

During the first season (1910) in which the branched ear was tested to see if it would reproduce the character only two out of fifty kernels planted produced individuals bearing the branched ears. It was at this time that the correlation between the tassel and ear type was discovered. The fact that only two plants of the *Z. ramosa* type were obtained this first year indicated that either the character was reproduced only occasionally or that it was a recessive character and that the parent was pollenated largely by neighboring plants bearing normal ears which must be dominant to the branched form. It was pre-

dicted[3] that the latter explanation was the true one, and the results from another generation (grown in 1911 from hand pollenated ears) have substantiated the prediction. Our data for this year show that the branched form of ear and its accompanying tassel type are recessive to the fasciated, cylindrical form of ear from which they originated.

Perhaps no one is ready to draw the limits upon that indefinable term "species," but Mendelian studies have thrown a bright light upon this mooted question. It is now very evident that sterility in hybrids is not a safe guide for determining what shall be a species. Darwin reported a number of cases to show the fallacy of this theory which was at one time advanced by Kölreuter, Gärtner and others. Mendelian studies have disclosed a number of cases of sterility (I have found several in corn) which are not due to hybridization nor to species' differences.

Systematic classification should be founded upon either the genotype or upon the Mendelian basis. The genotype basis would be feasible for self-bred and apogamous, including parthenogenetic, types of reproduction; while the Mendelian basis would undoubtedly be the most satisfactory for types of plants and animals that are continually mix-fecundated. We are learning that there are an almost inestimable number of characters in corn and that they may be quickly distributed to all the representatives of the six species-groups by hybridization. As an example: the kernel colors; red, yellow, blue and their absence (white) are found in all of the groups. If we were to give each distinct character, wherever we find it, a specific classification we should have many more species than we now recognize. This is especially true with regard to economic plants.

Such classification is desirable, however, and will soon be needed from a Mendelian standpoint if from no other. As an instance: we have evidence that there are more than twenty reds or phases of red color in corn alone, and a system for their classification is desirable. As was mentioned above, we have isolated a dozen distinct tassel types, each possessing a number of characters that may be easily redistributed by hybridization. The inheritance of detail in both plants and animals is various:

[3] "The Analysis of Characters in Corn and Their Behavior on Transmission," a paper submitted May 13, 1911, to the graduate school of the University of Illinois as a doctorate thesis.

when true dwarfs and true giants are hybridized, size segregates distinctly in their progeny; but when fluctuating shorts and talls are hybridized, size exhibits a so-called "blending" behavior that is generally complex. Thus it is evident that for recording such characters and their method of segregation we already need for the sake of conformity, brevity and ease in reference *a definite, simple, systematic classification of characters irrespective of species, varieties or individuals.* Bateson, by grouping characters of similarity under one head; Tschermak and others, by distinguishing "types" of segregation, have already taken a step toward this end.

The newly discovered type of corn is so radically different from all others yet reported, and since we are at present recognizing six species-groups of *Zea,* it seems very appropriate to add *Z. ramosa* as a seventh. And yet the writer will not be disappointed if the proposed addition is not recognized.

That *Z. tunicata* and *Z. ramosa* both originated as mutations we have no doubt; but as to the causes which led to the production of these two peculiar types, we have no definite knowledge. It has been proposed that new forms, aside from those developed by hybridization, are due to accidents in mytotic division; and yet those same writers are perhaps not ready to admit that even the greater proportion of the myriads of diverse forms of plant and animal life that exist on the earth to-day are accidents! This, of course, has nothing to do with the fact of chance meeting of gametes in reproduction.

The writer has evidence (not yet published) upon various strains of pod varieties and their hybrids with other podless varieties to show that the pod character, in that form, never was the normal or original pod or glume in *Zea;* and it is also evident that the new branched ear, as it is, is not a reversion to a former one. As may be seen at "*b*" in the illustration, the pithy core of the cob is not affected by the branching in the outer zone. The branches are somewhat fleshy and contorted as well as being very numerous. As stated above, no male florets have yet been found in the ears of the branched corn. Such evidence points to the conclusion that this is not a case of at least total reversion.

As is generally the case in such instances, it is only a matter of conjecture as to the causes that led to the production of this individual which, in so far as is known, was different from all

others in the history of the strain. Mr. W. T. Craig, who has been connected with the corn-breeding work at the University of Illinois for a number of years, states that to his knowledge no ear similar to this has ever been harvested on any of the breeding plots at this station.

The selection in the particular strain in which the branched ear was found has since been discontinued and thus we do not know whether the type would ever have occurred again in the same strain. Hybrid progeny from this parent strain are, however, yet being grown at this station; but no other individuals like the one here described have been found.

Several more generations of the branched corn should be grown before we can make any reliable statements as to its economic value. It is hoped that the new type may be developed by hybridization and subsequent selection among the segregates (which work is in progress now). As yet it does not bear as much grain as the unbranched ear in the strain in which it was found. The parent ear of *Z. ramosa* measured approximately 5.5″ in length and 9″ in circumference. Very little difference was found in the size of the other parts of the plants except that of the tassel, which is also slightly smaller on the new type.

The branched ear is apparently an ideal form to feed whole to livestock. The cob is of such nature that it may be readily masticated with the kernels and without the necessity of grinding or chopping before it is fed. It may also prove to be an ideal type for ensilage. Whether it will yield well enough to justify its production for any of these, or other purposes, remains to be investigated.